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DISCUSSIONS

THE REACTIONS OF CULTURE MEDIA[1]

It is to be hoped that the paper by Messrs. Bunker and Schuber will have a wide circulation among laboratory workers who are seeking to place their work on the higher level established by developments in recent years along the line of hydrogen ion concentration. The paper merits careful study in that it shows the application of this new knowledge and points out numerous precautions and pitfalls.

Considerable space has been devoted to a criticism of the subject matter in certain chapters of the Standard Methods of Water Analysis of the American Public Health Association, and also to omissions of certain kinds of information in this volume.

The reason for many of the shortcomings of the present edition of Standard Methods is found in the admission of the authors of the paper that it was compiled in advance of much that is known today and that it is not intended as a text book. The lack of such a book has been keenly appreciated for a long time by teachers, students, and laboratory workers, but it has never been the object of the Committee of the American Public Health Association to supply this need. Such has been the policy ever since the inception of Standard Methods, the editing of which has always been a labor of love and hardly calling for elaborate compilation. We must rely upon our teachers and such books and monographs as appear from time to time to supply the details necessary for the successful conduct of official methods.

The aim of Standard Methods has been to set down procedures which are accepted as the best after thorough trial. Consequently, there is a lag between important advancement and its adoption as an official procedure. The delay permits of a general dissemination of and familiarity with any newly incorporated procedure, the details of which are already available in print. Recent editions of Standard Methods are open to criticism for departing in some sections from this original aim. Procedures have been adopted one year to be cast aside the next, and the rapid change has weakened the prestige of an official publication. Attempted progress has been too rapid, suggestions have been adopted from round-table discussions without allowing sufficient time for general trial in the laboratory. There has been too little research and too much discussion.

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[1] This JOURNAL, p. 63.

It is pleasing, therefore, in the face of such conditions to have available for study and later corroboration a paper of the magnitude of the one presented by Messrs. Bunker and Schuber. The determination of H-ion concentration is a procedure which will subsequently find wide application in water works laboratories. The trend is that way and we shall profit sooner by it if there are made available more studies of the scope and character of the ones presented by these authors. Their paper goes a long way toward supplying the supplementary information on the subject, the lack of which they decry in Standard Methods. It is long, but gives a great deal of material which will serve to enlighten the reader who may be none too familiar with the subject. Full details of their own work are also included. In my opinion it would have been better to have brought forward to the opening pages of the paper the description of the preparation and use of color standards made up after Medalia's procedure. These register a real advance in laboratory methods and could well be emphasized at the expense of some of the criticism of the existing Standard Methods.

The experiments which compare the relative accuracy of phenolphthalein and the more sensitive indicators in registering H-ion concentration are of great value in the final adoption of the latter for the purpose. Likewise, the changes in the H-ion concentration of media during autoclaving, storage and dilution have been dealt with in a manner to give needed information on the subject. Studies of this kind will do much to furnish accurate knowledge in a relatively new field and assure the elimination of optional and questionable procedures from future editions of our Standard Methods. They will be hailed by committees having the publication in charge and by workers to whom the subject is new and who are still timid about making changes in established practices.

MELVILLE C. WHIPPLE.[2]

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[2] Instructor in Sanitary Chemistry, Harvard Engineering School, Cambridge, Mass.

"Why not make the 'Standard Methods' a little more human, a little more interesting, a little more *helpful?*" In propounding this suggestive question the authors unquestionably have spoken for a goodly majority of all who either make use of the "Standard Methods" or who would make use of such were they more helpful. The writer has in mind as this majority the following:

1. Graduates in chemistry, chemical engineering or bacteriology who may not have had courses in the chemistry and bacteriology or water and sewage.

2. Experienced engineers who have never had the opportunity of obtaining a knowledge of the chemistry and bacteriology of water and sewage or who have not had the time or opportunity to keep in touch with the subjects. Such men are daily becoming more aware of the necessity of an understanding of chemical, physical and bacterial phenomena. To these men a book of "Standard Methods," containing helpful notes and explanations where advantageous, would find its place on the desk as a reference book of real value.

3. Small plant operators.—In this class fall the many operators of small filter-plants or sewage-disposal plants. Although without more than a high school education, these men are anxious in many cases to understand and make the necessary laboratory tests. Constantly requests are coming in from them for help along this line. Here an improved "Standard Methods" would serve a thoroughly useful purpose.

The authors have also made reference to the fact that it is almost impossible for individuals who are interested in new developments in the laboratory to keep thoroughly posted on the subjects because of the large number of different publications which print the matter, few of which are available to men in small places unless they have sufficient funds to subscribe to all of them. The writer falls in this class and appreciates therefore the desirability of having incorporated in the book of "Standard Methods" greater details on the newer laboratory procedures.

It is believed that Messrs. Bunker and Schuber have in this paper contributed a much needed addition to the literature on hydrogen ion concentration determinations and the reaction of culture media. In the words of our bacteriologist Dr. Straus, "We were making hydrogen ion determinations, but we really did not know exactly what it was all about until we read the paper.

We have used it for a reference and will welcome its appearance in print to keep it as such."

LINN H. ENSLOW.[3]

The so-called "1920 edition" of Standard Methods for the Examination of Water and Sewage is a reprint of the 1917 edition with few emendations. Consequently it is not surprising that the section on adjustment of reaction of media is unsatisfactory.

In the forthcoming revised edition of Methods for the Chemical Examination of Water and Sewage, which it is hoped to complete and submit at the November meeting of the American Public Health Association in New York, will appear methods for determining hydrogen ion concentration in connection with the discussion of methods for determining acidity.

It was the conclusion of the committee, after considerable discussion of the matter, that Standard Methods should confine itself strictly to methods, with a statement of essential definitions and of the limitations of the methods.

To enter fully into a presentation of elementary chemistry (and bacteriology) would entail an inordinate enlargement of the text with corresponding increase in cost of publication. Instruction of plant operatives in technique and interpretation of results is outside the province of the committee charged with the work of revision, and seems best left to the initiative of authors of text-books, class manuals, journal articles, and above all to personal contact with trained and experienced men.

W. F. MONFORT.[4]

This excellent paper is both full and timely. It deals with a subject very much "in the air;" one upon which many members of the American Water Works Association will welcome light. Even though a superintendent of a large city water-plant may depend upon his staff for expert knowledge as to how best to secure information regarding the bacterial condition of the water under his charge, nevertheless he should not be ignorant of the meaning attached to scientific terms likely to be used in his annual report. For the small works man, who of necessity must cover all portions of the plant work personally, familiarity with "What is meant by Ph" and "What is hydrogen-ion-concentration" must be rated as among the necessities. The authors have drawn together many very valuable data from widely scattered sources not within the reach of water-men outside of large cities and have added thereto most interesting experiences and observations of their own.

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[3] Assistant Engineer, State Department of Health, Richmond, Va.

[4] Consulting Chemist, St. Louis, Mo.

Inasmuch as to some who have to do with water examination it is not clear just why so radical a change should be made in the matter of determining and adjusting the reactions of culture media, the thought presents itself would it not have been well to have added to the excellent tables given just one more showing numerically the differences between the old and the new forms of reaction control as illustrated by the differences in results for the same water when employing first one and then the other method of preparing the culture media.

W. P. MASON.[5]

TAPPING LARGE STEEL MAINS[6]

Mr. O'Brien has called attention to the fact that tapping large steel mains is done in the same way that cast iron mains are tapped, except that there are some variations in getting the clamps that go around the pipe properly to fit the pipe, due to variations in diameter and projections on the surface of fabricated steel pipe. This difficulty will be largely done away with where lap welded steel mains are used, as welded pipe are cylindrical, uniform in diameter, and have no projections of any kind on their inner or outer surface. The uniformity of diameter is due to the process of manufacture in which the pipes are rounded up and straightened after the pipe is welded. For pipe of relatively large diameter and thin wall there is, of course, danger of the pipe settling slightly out of round when back filling has not been made in a manner properly to support the pipe.

F. N. SPELLER.[7]

INTERFERENCE OF WELLS[8]

It is noted in the paper by Messrs. Chester and Davis that, whereas the mean annual rainfall over the artesian outcrop amounts to 48 inches, only 15 per cent or 7.25 inches is assumed to percolate, though possibly this may make some allowance for flow into the river bed. In England, when dealing with chalk or sandstone areas, the percolation is almost invariably taken at 10 inches; the range in mean rainfall being from 25 inches to 45 inches. It is not often that such ideal conditions for the measurement of interference effects occur in practice, and it is useful to know in such uniform material as prevails under Memphis that theory agrees with practice. The radius at which no interference takes place—something over 3000 feet—is closely in agreement with the results obtained in wells in the Triassic sandstones, though here the occurrence of faults sometimes leads to apparently anomalous results. The writer knows of one case of a chalk water supply in which a copious yield was obtained from one boring and from another only 10 feet away, nothing at all. The explanation is that the only available water in the chalk is that which flows in the fissures, and these may be but a few feet apart or 5 or 6 feet, and the only way of ensuring an adequate supply is by means of adits to intercept the fissures. The conception of a radius of non-interference therefore in such formation as the chalk is one which must be used with caution and only with an adequate knowledge of the character of the material, the direction of major and minor fissures, and the geological structure of the district.

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[5] Professor of Chemistry, Rensellaer Polytechnic Institute, Troy, N. Y.

[6] This JOURNAL, p. 54.

[7] Metallurgical Engineer, Pittsburgh, Pa.

[8] JOURNAL, July, 1921, p. 377.

H. J. F. GOURLEY.[9]

COLLOIDAL CHEMISTRY AND WATER PURIFICATION[10]

Mr. Stein's paper contains an abundance of matter that requires careful examination and will serve the useful purpose of compelling us to consider critically the indictment as to the relation of water purification to colloidal chemistry.

The writer believes that the rôle of mass action has long been recognized but that this phase of physical chemistry was found to be insufficient to explain the whole of the phenomena involved. This is well illustrated by the facts given in the earlier part of the paper. In distilled water, it is stated, the reaction of alum and alkali is slow but in turbid water "the reaction is much more rapid, and the coagulation is good and settlement rapid." If the kaolin suspension is inert, as is generally admitted, the law of mass action requires that the reaction velocity is identical in both cases. Chemical action ceases at this point and we have next to consider the physical state of the reaction products. Colloidal chemistry provides a satisfactory explanation of the subsequent phenomena and to this extent at least the science of water purification is indebted to the colloidal hypothesis.

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[9] Sir Alexander Binnie, Son and Deacon, Victoria Street, London, England.

[10] JOURNAL, November, 1921, p. 571.

Much unnecessary confusion has arisen through the indiscriminate use of reaction and visible reaction as interchangeable terms. The alum-alkali reaction according to the writer's experiments is a rapid one but the visible reaction may be nil or comparatively rapid. When alum is added to the Ottawa River water the visible reaction occurs in about 30–45 minutes, but if the water is filtered through paper immediately after the alum is added, the color is removed. This is not conclusive proof that the reaction is practically instantaneous but it is much more probable than that the filter paper accelerates the reaction.

Colloidal chemistry does not explain the difficulties encountered with many waters but on the whole the colloidal hypothesis is a definite advance on previous ones and will be used until new facts provide a more rational one. At present the cases which it does not explain satisfactorily are due probably to our inadequate knowledge of the various colour colloids found in water. Mr. Stein takes tannates and gallates as being typical of the complex substances present, but if this were true there should be a greater correlation between the colour and the iron content than is usually found. Humic, ulmic and other acids are often present in coloured water and these form brown colloidal solutions with ammonia, magnesia, and lime.

The coagulation and removal of colour from waters cannot be explained by any single branch of physical chemistry. Mass action explains part of the phenomena; colloidal chemistry another part; and ionisation and dissociation still another part. All must be considered collectively if we are to obtain a better understanding of the process known as coagulation.

JOSEPH RACE.[11]

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[11] Hereford House, England.

SHORTCOMINGS IN THE PRESENT STANDARD METHODS OF WATER ANALYSIS FROM THE OPERATOR'S VIEWPOINT

Mr. Birdsall's criticisms[12] of the present standard methods of water analysis appear to divide themselves under two main headings.

In the first place Mr. Birdsall desires an expansion of the standard methods report so that it will give more detailed information in regard to certain points in sampling and analysis. With these criticisms I find myself heartily in accord. It would certainly be most helpful to include in a new edition of the standard methods data bearing on such points as the formula for cleaning solutions, the exact method of collecting a water sample, and the procedure in determining color, and the like. There are also certain specific changes in the present procedures suggested by Mr. Birdsall which should receive the most careful consideration. I am personally strongly in sympathy with the substitution of hydrogen-ion determinations for the old method of titration just as soon as the laboratory workers of the country are ready to support such a step.

A second group of modifications suggested by Mr. Birdsall seem to raise a question of a very different kind. These are the suggestions which look toward the inclusion in the standard methods report of statements bearing on the interpretation of the results obtained. It is possible as Mr. Birdsall has pointed out to train a laboratory worker who has no extensive preliminary background to perform routine analytical work and he should have the fullest directions to enable him to do so. When it comes to interpretation, however, I think short cuts are exceedingly dangerous. We have suffered too much in the past from the attempt to use arbitrary yardsticks of various sorts in sanitation and the plain truth is that no one can learn to interpret chemical and bacteriological examinations of water without a very careful study of such detailed textbooks as are now available. It would be absurd in a report on standard methods to reprint these textbooks on the fundamental principles of water bacteriology and water chemistry and anything short of such a full presentation would merely lead to a fallacious and dangerous assumption of non-existing knowledge. Analyses can be performed by an imperfectly trained laboratory worker but they can not be safely interpreted by anyone who is not really a master of the subject. I believe therefore that the committee on standard methods has been very wise in avoiding the attempt to deal with the interpretation of results in any condensed form.

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[12] This JOURNAL, page 56.

C.-E. A. Winslow.[13]

PROGRAM FOR ANNUAL CONVENTION

The program for the annual Convention at Philadelphia is now being prepared. Suggestions regarding topics for discussion and particularly regarding papers on any phase of water supply are invited. Members are urged to send these suggestions at once to the Chairman of the Publication Committee, Robert B. Morse, Chief Engineer, Maryland State Department of Health, 16 West Saratoga Street, Baltimore, Md.

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[13] Anna M. R. Lauder Professor of Public Health, Yale University, New Haven, Connecticut.